

Installation

7

This is where your photographs and notes are going to pay off. Since there are so many variations between the various engines, transmissions, transaxles, vehicle types, and model years, it's difficult to put the engine back in your car or truck and have it run right without photos and notes to help guide you. And it's next to impossible if you've left the vehicle sitting for a few months or longer.

If you don't have photos and notes, carefully check each component mounting bracket, component, vacuum line, fuel line, and wiring harness as you assemble it to the engine. If something doesn't fit correctly, it's probably not mounted right or in the

wrong place. Whatever you do, don't force anything to fit.

For detailed information on vacuum line routing, check the underhood sticker. These stickers are specific to a particular vehicle/engine/transmission combination and can be of great help.

Preparation

You'll need at least one assistant to help you install the engine; an extra pair of hands to help you maneuver the engine and another set of eyes to watch for problems will be a definite asset at this point.

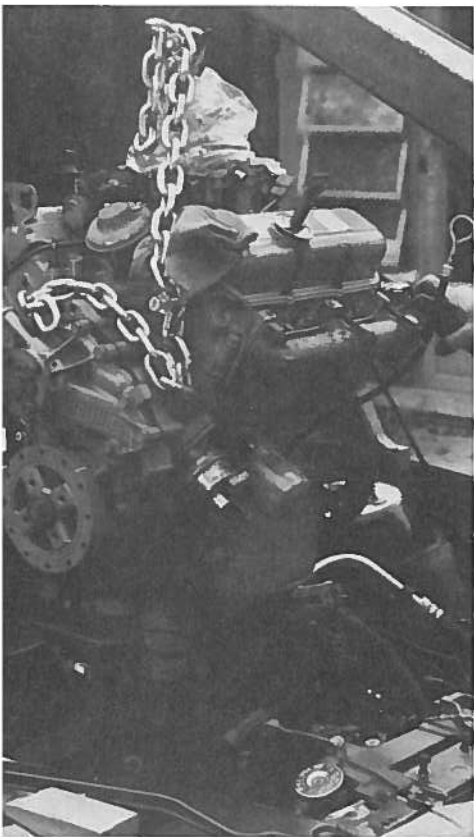
To help protect the paint on the body, lay some old blankets over the fenders and front of the vehicle. And to save your back, it's a good idea to raise the car on jackstands after securing the engine in the engine compartment. Use the jacking points outlined in the owners manual and make sure the vehicle is properly supported before you attempt any work on it. It's also a good idea to level the transmission with a floor jack. You can use blocks of wood to do this if you don't have a floor jack, but the floor jack allows you to raise and lower the trans-

mission as needed—a definite asset when you're trying to couple the engine and transmission. Just be sure to place a board between the cup of the jack and the transmission to avoid damaging the transmission pan and valve body.

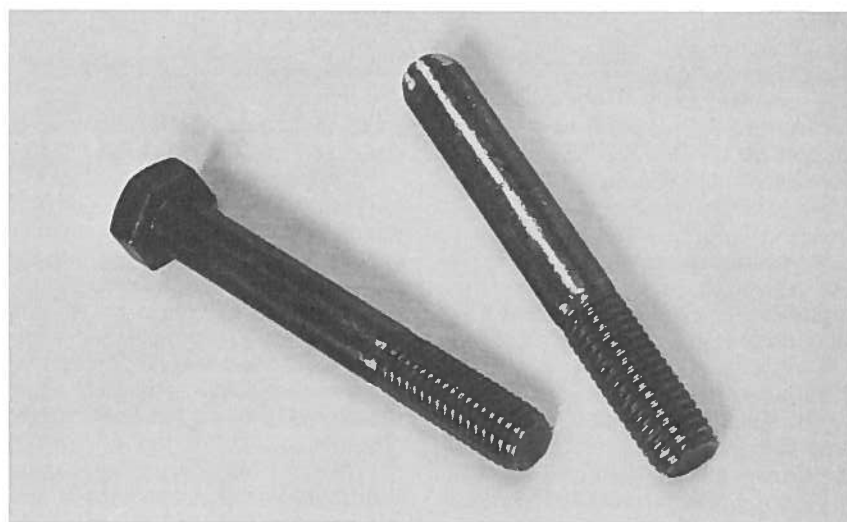
If you have a front-wheel-drive car, be sure to place the exhaust packing in the exhaust pipe that leads to the catalytic converter when the engine isn't installed, as you probably won't be able to access it later. Remember, the flat section of the packing faces the manifold and the ball section goes toward the exhaust pipe. Also be sure to install the water pump pulley before you install the engine, because there isn't enough room in front of the water pump when the engine's in the car.

If you have a rear-wheel-drive vehicle, don't install the distributor cap until the engine is in the chassis. That way if the distributor hits the firewall during engine installation, you won't crack the cap.

The toughest job you'll likely have during installation is the joining of the engine to the transmission. A couple of guide pins will make this



Now that you're ready to install the engine, try to contain your enthusiasm. It's better to take a little longer and make sure the job is done right.



Make a pair of guide pins by cutting the heads off of 4in long 12x1.75mm bolts and rounding the ends. Use of these

pins is a blessing, especially for those of you trying to mate the engine to a manual transmission.

Engine Compartment Preparation

Before you lower your freshly rebuilt engine into place, it's a good idea to clean the engine compartment and make any necessary repairs to the wiring, paint, and any other thing that needs to be repaired. It's much easier to do it now that the engine is out.

Before you start spraying solvent into the engine compartment, you need to consider the effect it may have on any rustproofing material residing there. Petroleum-based cleaners can remove rustproofing given sufficient time. To avoid this situation, use soap, water, and a stiff-bristled brush to remove all the dirt and crud. Sunlight dishwashing liquid, Formula 409, and Simple Green work well.

After removing the dirt and grease, take stock of any paint damage, rust, frayed wires, cracked hoses, neglected components, and anything else that wasn't the way it was when your vehicle left the factory.

Paint that has been damaged down to bare metal should be cleaned with a wax and grease remover. Then all the rust should be sanded (or sand-blasted) away, the surface conditioned with a metal conditioner, primed, and painted. All of the products needed to do this are available at your local automotive paint store. Follow the manufacturer's instructions for the best results and to limit the hazards of using these products.

Metal conditioner can also be used to remove all but the most severe

cases of rust. Combine it with 150-grit wet-or-dry sandpaper for the best rust-removing action. Be sure to wear rubber gloves and eye protection to avoid injuring yourself with this acid-based conditioner.

Repair of frayed wires is another job to complete before engine installation. Damaged insulation can be repaired by cleaning the wire with Formula 409 spray cleaner, drying it, and then covering the damaged area with a good-quality electrical tape.

If some of the wire strands are cut, it's wise to cut the wire and install a butt connector. For the best possible repair, the wires should be soldered to the connector and a portion of the wire before and after the repaired area is covered with heat shrink tubing.

Also watch for cracked, deteriorated, and otherwise damaged hoses. Heater hoses that feel very hard when you squeeze them should be replaced because their elasticity is gone and they will be prone to cracking. Since an engine vacuum leak can cause all sorts of driveability problems, any vacuum hoses that are cracked should be replaced also.

Any components that may soon need service should be attended to as well. This can include the heater core and steering rack assembly to name just two. Remember, access to these parts will never be easier than with the engine out of the way.

Prior to lowering the engine into the compartment, move all wires and hoses out of its direct path.

easier, especially for those of you with manual transmissions. These guide pins will help you align the engine to the transmission and are simply 12x1.75mm bolts about 4in long with their heads cut off. After you cut the heads off, put a generous radius on the unthreaded end of the bolts so that they'll slide into the bell housing easier. Screw the guide pins into the bell housing so that they're positioned away from each other as far as possible. This positioning will make the mating of the engine to the transmission much easier.

Installation

Begin installation by slowly wheeling the engine over to the vehicle. Be sure to keep the engine close to the ground when moving the hoist, as this lowers the hoist's center of gravity and minimizes the chances of it flipping over if you hit a nasty crack in the pavement.

When you get the engine over to the front of the vehicle, slowly raise it until the bottom of the oil pan clears the front of the vehicle by 4–6in. Then carefully push the hoist toward the back of the vehicle until the engine is positioned above its old home in the chassis.

With your assistant guiding you and watching for obstacles directly under the engine, lower the engine a few inches, then stop. Carefully appraise the situation once again to make sure that there are no obstructions and that the engine is heading where you want it to go. Repeat this process until the engine is within about one foot of its final resting place.

Now assess the engine's angle. Will it allow the nose of the torque converter or the input shaft of the transmission to align with the center of the crankshaft? If not, try raising the front of the transmission with the

floor jack. If you have a front-wheel-drive car, you also need to determine whether the engine will clear the right-hand frame rail of the chassis, as well as allow for alignment of the transmission to the crankshaft. If it won't, you'll need to remove the engine from the vehicle, reposition the lift chain on the hoist, and try again. When the engine's on the proper angle, slowly lower it into position. While doing this, watch that you don't pinch any wires or hoses or nick any body parts.

If your engine is mated to a manual transmission and the transmission wasn't removed with the engine, shift the transmission into first gear. This will lock the input shaft in position, making it much easier to align it with the splines in the clutch disc.

On a front-wheel-drive car, position the studs from the front motor mount into the chassis before joining the engine to the transmission. When the studs are through the chassis mounting plate, screw the nuts on just a couple of turns. This will help prevent them from popping back out as you join the engine to the transmission, yet allow the mount to move during the mating process.

Joining Engine and Transmission

Now for the most difficult part: joining the engine and transmission. With the rear of the engine positioned directly in front of the bell housing, align your homemade guide pins on the back of the block through the corresponding holes in the bell housing. You may have to raise or lower the engine or transmission to do this.

Once the guide pins are in position, slowly shake the engine side-to-side while pushing it back toward the transmission. As you do this, make sure the alignment sleeves in the rear of the engine align with the oversize holes in the bell housing. With a little bit of luck, the converter or input shaft will fall into position in the back of the crank. You'll know when it does because you'll be able to push the rear of the engine within 1/4in or less of the bell housing.

If you can't seem to get the engine mated with the transmission, raise or lower the engine or transmission and try again. Bringing these two together may take a little time and patience. Whatever you do, don't try to draw the engine to the transmission using the bell housing bolts, be-

cause if the transmission isn't aligned with the crank, you can destroy the transmission.

To check your work, put the transmission in neutral and try rotating the torque converter or flywheel. If it rotates freely, you're home free. Install the rest of the bell housing bolts and tighten them to specifications.

Connecting Motor Mounts Front-Wheel-Drive Vehicles

On some front-wheel-drive vehicles, a bracket is used to connect the transaxle to the back side of the block. This bracket is positioned on the end of the transmission, above the right-hand axle shaft. To connect this bracket to the block, you'll need to loosen its retaining bolts on the transaxle. Then shift the bracket so that the bolt holes line up with those in the block, and slide the bolts through the bracket. Screw the bolts into the block a few turns. Tighten the transaxle bolts first, then the bolts securing the bracket to the block.

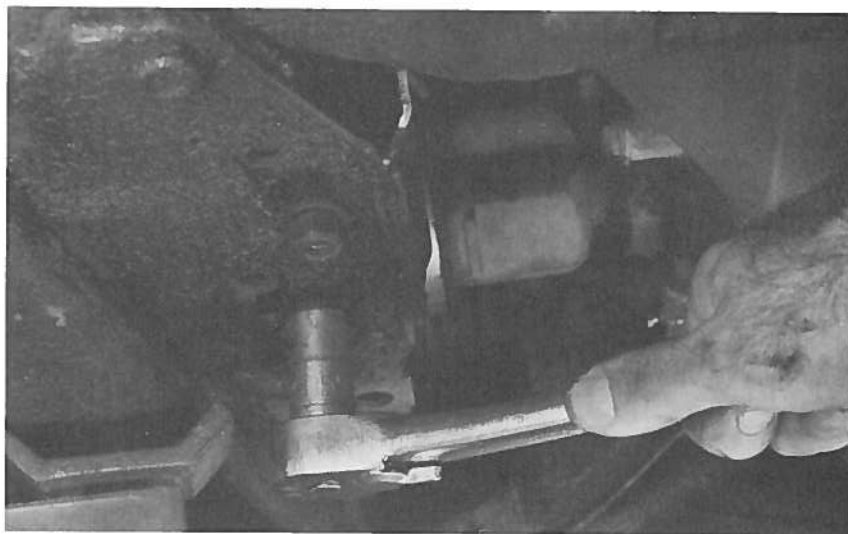
Rear-Wheel-Drive Vehicles

If you're working on a rear-wheel-drive vehicle, you'll need to lower the engine while aligning the bolt holes in the front motor mounts with the bolt holes in the mounting ears in the chassis. Rarely can you get both mounts lined up at the same time. If you can't, just slide the bolt through the mount that does line up, then tackle the other. You may have to lift and lower the engine several times to do this, as the mount has to seat itself on the ears. When the holes align, slide the remaining bolt through them. Be sure to orient the bolts in the same direction they were before you removed them. Then install the prevailing torque nuts and tighten them.

With the engine securely in position, you can begin to connect all the pipes, hoses, and wiring.

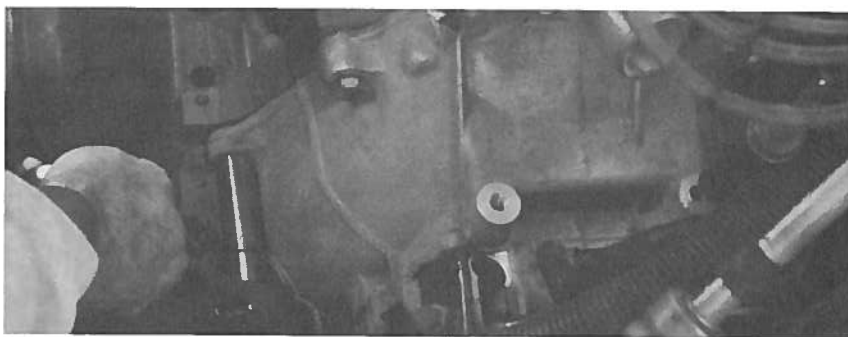
Torque Converter Bolts

Before installing any of the flexplate-to-torque converter retaining bolts, align the marks you made on the torque converter and flexplate. These marks must align to avoid an imbalanced engine. If you need to rotate the flexplate to do this, insert the tip of a large, flat-bladed screwdriver between two teeth on the flexplate. Then rest the shaft of the screwdriver against the side of the inspection hole



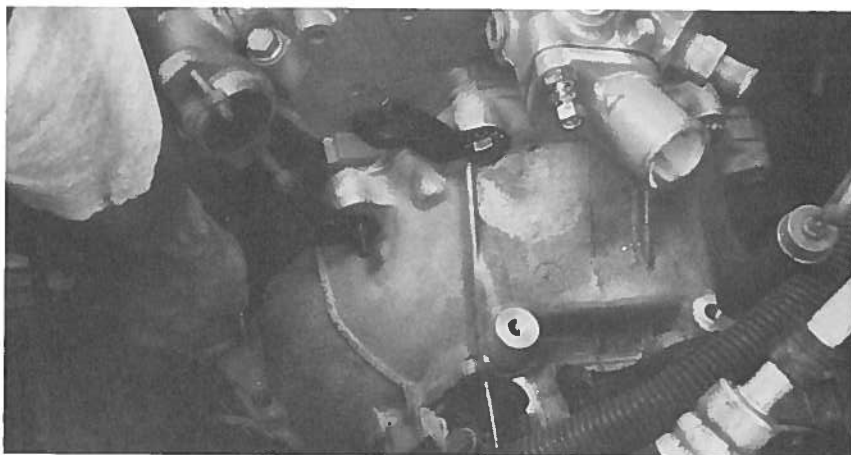
To keep the motor mount studs from pulling out of the chassis, screw the nuts on a few turns. Start the nuts by

hand, then tighten another turn or two with a ratchet.



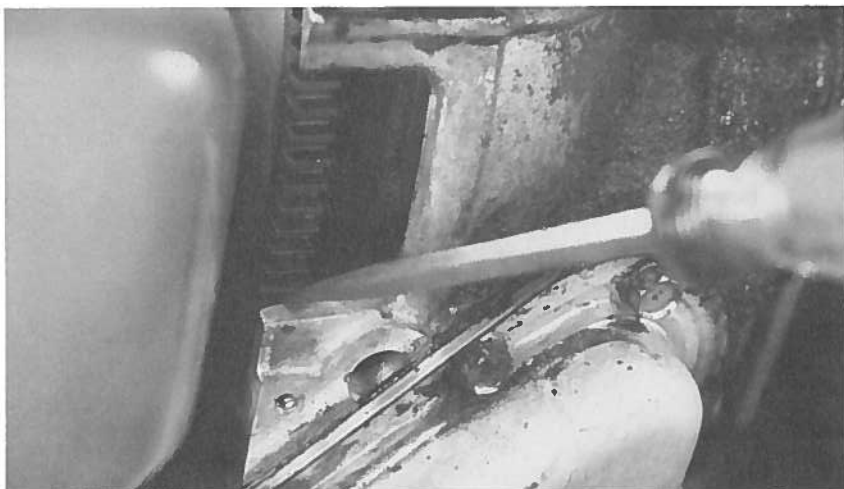
Note the small gap between the engine and the bell housing. This is how close the engine should be to the bell housing before the bell housing bolts are tight-

ened. If the engine is much farther away than this, it isn't properly aligned to the transmission.

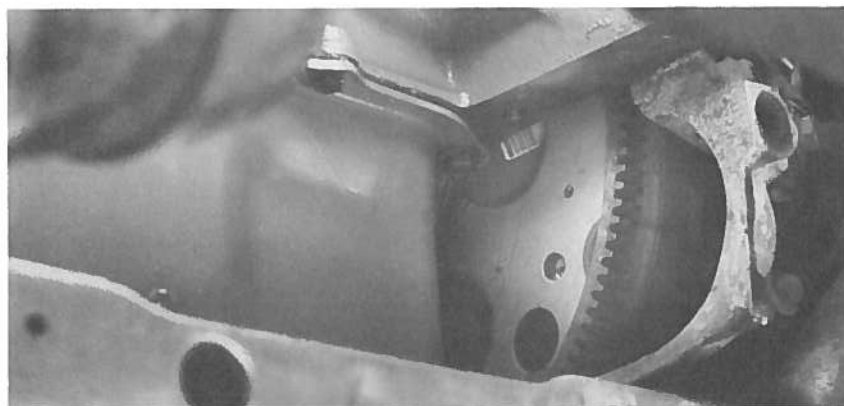


In most cases, brackets and clips are secured to the bell housing bolts. Remember to install them. Don't forget to

install the bolt and nut at the lower edge of the bell housing.

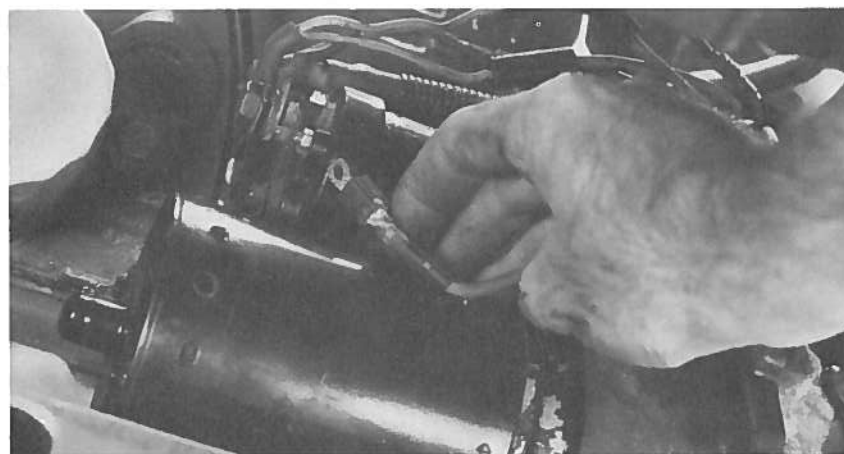


Use a screwdriver to lever the flexplate around. The edge of the case is used as the fulcrum.



With the starter out of the way, it's easy to slip the bolts through the flexplate into the torque converter. If your starter

uses shims, be sure to install them before you bolt the starter up.



Correctly installing the starter wires is straight-forward. If a wire has a large-diameter ring, it fits over the large lug on

the solenoid. Wires with small-diameter rings are usually fitted to just one stud on the front of the solenoid.

in the case, and lever the flexplate around. This technique also works well for locating the holes for the retaining bolts, which are most easily seen at the starter motor cavity in the bell housing.

Before you install the retaining bolts, apply some Loctite 242 to their threads. When all the bolts are installed, torque them to specifications while your assistant holds the flexplate with a screwdriver.

Starter

To install the starter, first make sure that the starter mounting boss on the block is clean and free of paint. Contaminants will prevent the starter—and the terminals on the starter solenoid—from grounding properly, which, in turn, will keep it from operating.

When these areas are clean, grab the starter and slip its nose into the relief in the bell housing. Then align the mounting holes in the starter with those in the block and screw the mounting bolts in finger-tight. Start with the short-er bolt because it's easier to pilot through the starter. Shift the starter around as necessary to get the bolt started into the block.

While you're doing this, keep your body out from under the starter because it's easy to be fooled that the bolt has started when it really hasn't. So any movement of the starter will cause it to come crashing down on whatever's underneath.

When the short bolt is screwed in three or four turns, start the longer bolt. If your starter doesn't use shims, tighten the starter bolts, and you're finished. However, if your starter uses shims, after screwing the longer bolt in three or four revolutions, pull down on the starter so that there's a gap between it and the block. Then remove the shorter bolt, and slide the forked end of the starter shim over the shaft of the long bolt. Finish by sliding the shorter bolt through the shim, screwing it into the block and tightening both bolts.

With the starter secured to the block, connect the wiring to the solenoid. Slide the positive lead from the battery on first, making sure its locating lug fits into the recess on the solenoid. Then slide the remaining wires over the lug and install and tighten the retaining nut and washer. Also be sure to connect the purple wire to the small stud on the front of the solenoid. To ensure a good connection, install

the serrated washer underneath the wire.

Fuel Lines

If your engine has a fuel pump, now's the time to connect the fuel lines. Prepare the fittings by applying automotive pipe thread sealant to their threads or wrapping their threads with teflon tape. Two revolutions will do, and make sure the tape doesn't hang over the ends of the fittings. Screw the fittings into the fuel pump and tighten them securely.

If you had to remove the fuel line hoses from the pre-bent steel fuel lines, install them now. Remember, one line is larger than the other, so don't mix them up when installing them onto the tubing.

Crankshaft Pulley

If you haven't yet installed the crankshaft pulley, do it now. Begin by removing the damper bolt and washer. Then position the pulley against the damper so that its holes line up with the threaded holes in the damper. After applying two or three drops of Loctite 242 to the threads of the pulley retaining screws and damper bolt, install them finger-tight. Then torque the bolts to specifications, starting with the damper bolt. If the crankshaft turns as you're tightening the bolts, hold the flywheel or flexplate with a screwdriver as described earlier.

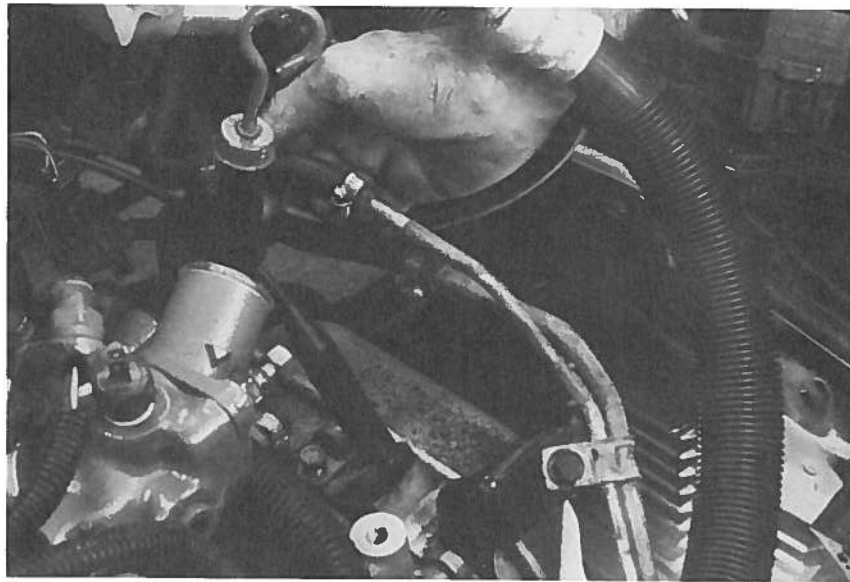
Inspection Cover

To install the inspection cover on front-wheel-drive vehicles, you'll need to snake it down between the starter and front cross member. If the cover hangs up while you're snaking it through, the ridges on the cover are probably catching on the bell housing. When the cover's in position, screw the retaining screws in and tighten them.

Inspection cover installation on rear-wheel-drive cars is straightforward: Position the cover to the bell housing and install the retaining screws.

Accessories

Before mounting any accessories, install their mounting brackets. If you position a bracket to the engine but none of the mounting holes seem to line up, try reversing the bracket. If it still doesn't fit, you've probably got the wrong bracket. Start with the brackets mounted to the engine first,



Remember to connect the fuel line hoses to the steel supply lines. Note that the steel lines are supported by a

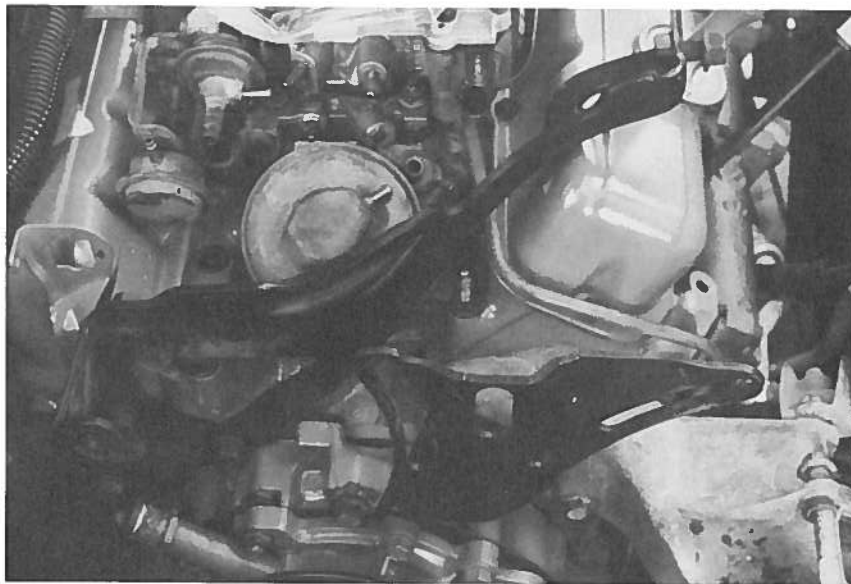
bracket that attaches to the transmission. This prevents the fuel lines from fatiguing and causing a fuel leak.

then work your way out to the water pump.

Begin with the accessories that are closest to the engine and positioned low. This will allow you to access these components more easily and provide you with more working space. If you have trouble aligning the holes in the mounting brackets with those on the accessories, loosen the bolts on the mounting brackets until

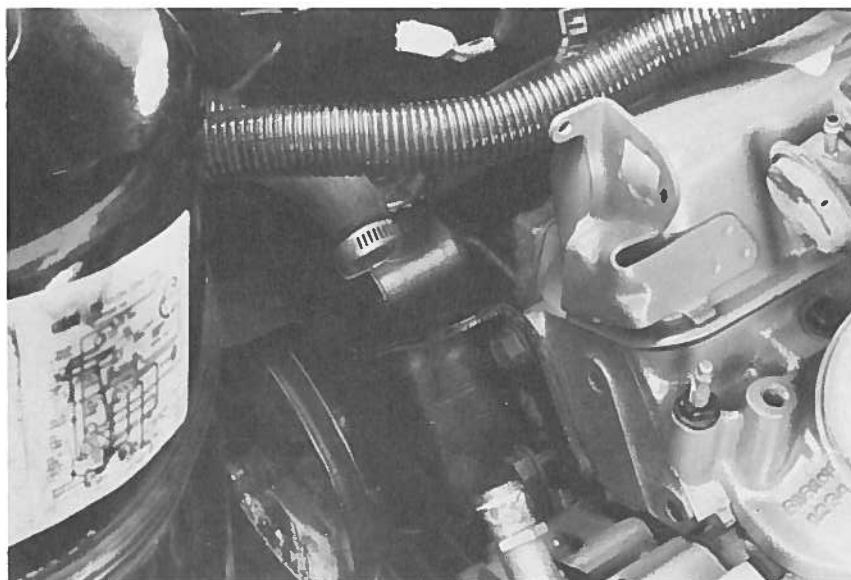
you can slide the bolts through the accessories and the brackets. Then tighten the bracket mounting bolts, followed by the accessory mounting bolts.

Due to the overwhelming variety and positioning of the various accessories, it's just about impossible to provide you with explicit assembly directions. However, the following information will provide you with some



The way some brackets snake, it can be difficult to remember how they were installed. Note that some brackets are

mounted to the heads, while others are secured to the water pump.



The power steering pump bracket is usually mounted to the cylinder head on front-wheel-drive vehicles. After

mounting the bracket, be sure to connect the heater hose to the nipple on the water pump.

helpful reminders and tips for installing the accessories.

Power Steering Pump

As you install the power steering pump, make sure that its lines aren't twisted and that you've connected the wire to the pressure switch (if it uses one).

Air Conditioning Compressor

Remember to install the two-blade connector onto the compressor

clutch and the push-on connector at its rear. If the air conditioning or vent system doesn't work, these wires are probably not connected. To prevent the air conditioning hoses from chafing through, be sure to install their supporting clips to the engine or chassis as you found them.

Alternator

After installing the alternator, run the wiring to it. Be sure that it's routed as far away as possible from

any sensor or sensor wiring to prevent electro-magnetic interference (EMI). This is especially important for the battery lead (the thick, red wire) that's attached to the back of the alternator, because it carries high amperage—and high amperage can have a negative effect on electrical signals sent to the ECM. Refer to the "Electro-Magnetic Interference" sidebar in this chapter.

After connecting the battery lead to the alternator, slip the rubber boot over it. This will inhibit an electrical system short and the possibility of frying your computer.

AIR Pump

Replace the hoses leading to the AIR pump if they are cracked or abraded. Also replace any questionable hose clamps when connecting the hoses to the AIR pump.

Accessory Drive Belts

After all the accessories are in position, you can begin installing the accessory drive belts. If any of the belts are in questionable condition, now's the time to replace them.

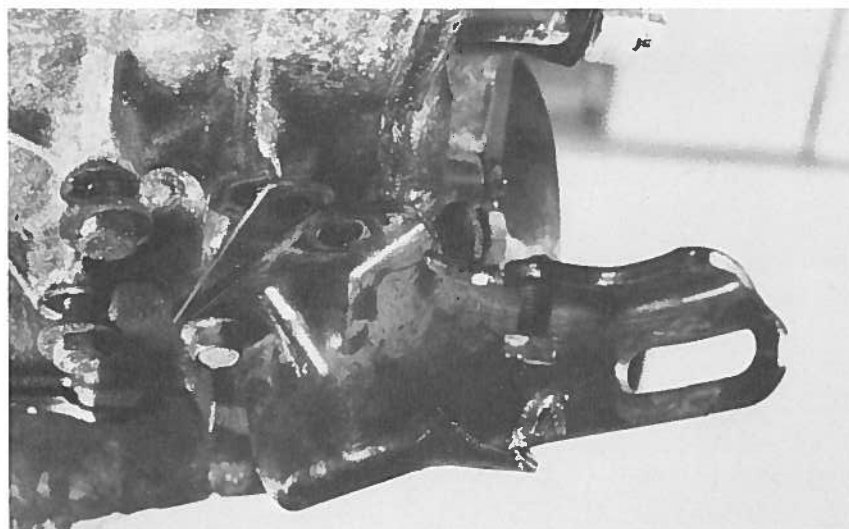
V-Belts

Begin installation by first installing the belt closest to the engine, then working your way outward until all belts have been installed. In some cases, it's a good idea to tighten the belts as you install them because of space limitations within the engine compartment.

Take care not to overtighten these belts as it causes premature wear of the bearings in the driven accessories, as well as the front main bearing in the engine. If you don't have a belt tension gauge, a general rule of thumb is that the belt is properly tensioned when you can rotate it about 90deg between its farthest, unsupported points. If you can rotate it more, it's too loose. If it rotates less, it's too tight.

Serpentine Belt

If your engine uses a single serpentine belt with an automatic tensioner, thread the drive belt around the accessories in the same manner that it was previously installed. If you've forgotten how to route the belt, most cars have an underhood decal that illustrates belt routing. When installing the belt, make sure that the ribs in the belt are properly centered on the various drive pulleys. Then in-



Shims are used between some power steering pump mounting brackets and the block. Be sure to reinstall the shims.

sert the end of a breaker bar or ratchet into the square hole near the idler pulley on the end of the tensioner and rotate the tensioner away from the engine. This will allow you to move the belt back toward the front of the block so that the idler wheel on the tensioner will apply tension to the side of the belt.

When you run the engine for its half-hour break-in period, don't turn any of the accessories on. After the break-in period, check the tension of belt by placing a tension gauge on it halfway between the alternator and the power steering pump. Then put the breaker bar back in the square hole in the tensioner.

Use the breaker bar to apply tension against the belt and then totally release the tension against the belt. After each time, let the tensioner move back to its natural position and check the tension readings. Averaged together, the three readings should be 50-70lb. If they're not, you need to replace the tensioner.

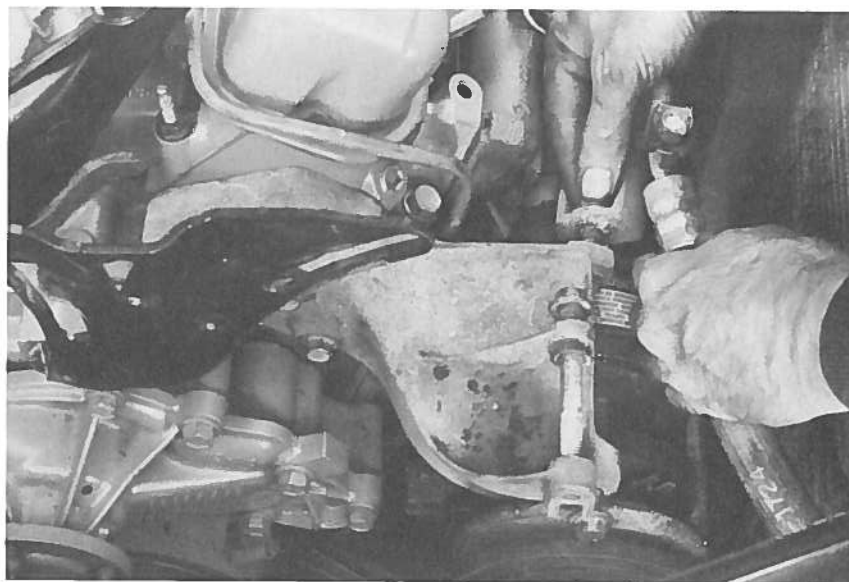
Wiring

Before connecting the various wires under the hood, look closely at the connectors themselves. The terminals inside the connectors should be straight and clean. This is especially true for the connectors used with the C3 system, which can be identified by the presence of a pleated silicone seal on one-half of the connector.

If the terminals inside the connectors aren't clean, their resistance to current flow will be higher than normal. The higher the resistance, the greater the chance of impeding current flow in these low-ampere circuits. This translates into a potential driveability problem. To clean these terminals, spray them with circuit board cleaner.

It's important that the terminals in one-half of the connector fit snugly into the terminals in the other half of the connector. If they don't, the circuit will not be completed or the terminals may make contact only intermittently, causing an on-again, off-again problem. The best way to check the fit of your terminals is with new terminals of the opposite sex from your local GM dealership. These terminals are usually kept on hand behind the parts counter for routine service and come in a wide variety of sizes and shapes.

Finally, almost all connectors use some sort of safeguard to ensure that



Mounting the air conditioning compressor can be a little trying because of its hoses. Be sure to fit the air conditioning

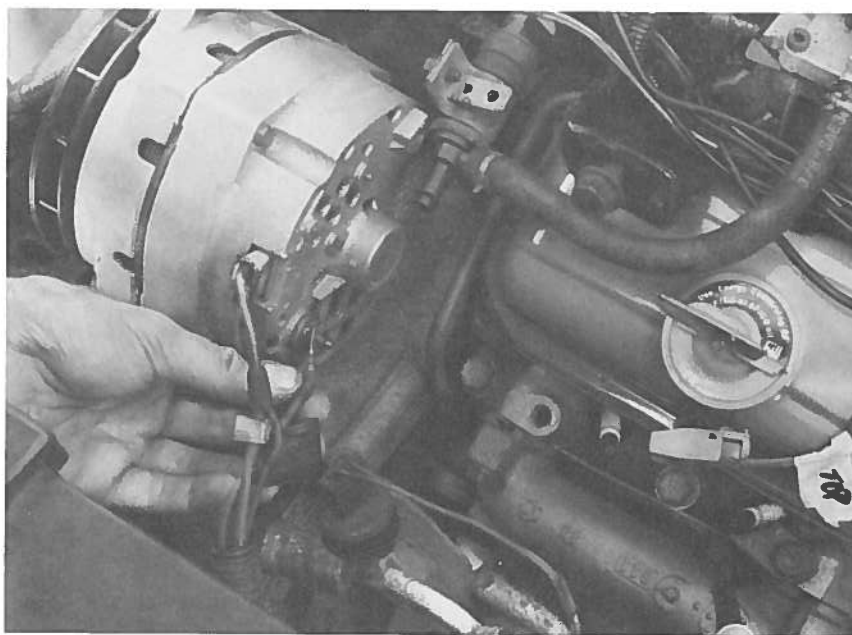
hoses into their original mounts so that they don't get chafed.

the halves of the connector are properly mated to each other, avoiding electrical disaster. These safeguards usually take the form of a tab on the outside of one half of the connector that latches into a hook on the other half. When mating connectors, the tab and hook should be aligned with each

other and securely latched to keep them together.

Harness Routing

Routing of the wiring harnesses is fairly straightforward if you keep two things in mind: heat and EMI. Hot components, such as the exhaust



The wire being connected to the back of the alternator is connected directly to the battery. Make sure these wires are

routed away from any sensors and their associated wiring, or driveability problems can result.

manifolds, will melt the insulation off wires in a few seconds, so when routing the harnesses, keep them away from sources of extreme heat.

Although it isn't as readily apparent as hot exhaust manifolds, EMI can greatly affect vehicle driveability. So you need to pay extra attention when you're routing the wiring harnesses to minimize the chances of EMI. For more information, see the nearby "Electro-Magnetic Interference" sidebar.

If you're not sure how to route the harness, start with the connector farthest away from the end of the harness. Working your way toward the end of the harness, connect each connector and the harness will almost route itself. Just remember to keep it away from sharp edges and sources of heat and high current.

I hope you've taken notes about which wires went where. Because of the numerous variations between engines, fuel systems, and vehicle equipment, I can't give you specific information on wiring. However, I can offer some general guidelines.

The battery ground cable on front-wheel-drive cars is usually fitted to one of the bell housing bolts, and a ground from the chassis or ECM is also connected here. Before installing the ECM ground wires inspect them closely. Are they securely crimped by the ring connector? Is the ring connector in good shape and free of corrosion? A clean, tight ECM

ground is essential to proper vehicle operation, so take care of it now. A poor connection here can cause a host of driveability problems, including stalling and surging. The connecting point for the ground wire is important as well. It should be free of corrosion and paint to ensure a proper ground.

Some wiring harnesses use brackets secured to the engine. Make sure that these brackets are back in their proper positions to prevent damage to the harness.

The terminals on both male and female sides of the connectors must be straight and free of any dirt or corrosion. Use circuit board cleaner to remove dirt from the connectors. When installing the connectors, push them in far enough to engage the locking tab. This will minimize the chances of an intermittent driveability problem.

Crossover Pipe

If the vehicle you're working on has front-wheel-drive, you'll need to install the crossover pipe from the front exhaust manifold to the rear exhaust manifold. Before you do this, make sure all the mounting brackets and associated hardware are in place on the back of the heads. In some cases, you won't be able to mount these items once the crossover pipe is in position.

To install the crossover pipe, loosen the screws on the front exhaust manifold, and slide the manifold toward the front of the vehicle. Now slip

one end of the crossover pipe between the studs on the rear exhaust manifold. Take the other end of the crossover pipe, and slide it into the end of the front exhaust manifold. Move the manifold as necessary to get the crossover pipe to slip into it, then tighten the front exhaust manifold bolts. Finally, slip the crossover pipe flanges over the studs on the manifolds, install the stud nuts, and tighten them securely.

Exhaust System

Before connecting the exhaust system to the engine, make sure that the exhaust packing is fully seated into the exhaust manifold(s). Remember, the flat portion of the packing fits

Electro-Magnetic Interference (EMI)

Electro-magnetic interference (EMI) might be new to your vocabulary, but it's not new to the wiring surrounding your engine. What is EMI? An electro-magnetic field is produced when electricity travels through a wire, and the greater the amperage or current, the stronger the electro-magnetic field. When a wire is isolated, there's no real problem. Problems arise, however, when high-amperage or high-voltage wires, such as those connected to the alternator and spark plugs, are positioned next to the wiring used with the Computer Command Control (C3) system.

Remember that the wiring used in the C3 system usually has very little current flowing through it—typically in the milliamp range—and the electronic control module (ECM) makes changes to the fuel and ignition and emission systems based on these tiny signals. So, if a high-amperage wire is routed next to one of these low-amperage circuits, the electromagnetic signal that radiates from the high-amperage wires will actually cause a small amperage change in the wire. In turn, the signal the engine computer gets from the sensor the wire is connected to won't be accurate. This can cause a number of engine driveability problems, such as bucking, jerking, and a poor idle.

The moral of this story is simple: To prevent EMI problems, route all wires carrying high amperage or current at least 1-1/2in away from the low-amperage wires used with the C3 system. This list includes, but is not limited to, the wires leading to the coolant temperature sensor, throttle position sensor, fuel injectors, MAP sensor, and oxygen sensor.



Use a pry bar to tighten the belts as you snug up the adjustment bolt(s).

into the manifold and the spherical section will seat against the exhaust pipe.

To connect the exhaust system, pull the exhaust pipe(s) toward the manifold(s), then slip the bolts (with the springs on) through the flange and screw them into the manifold. When the bolts are in, tighten them securely. Due to engine packaging, some front-wheel-drive cars will have to have one bolt started from underneath the car and the other from above.

If replacement of the oxygen sensor is necessary, you'll need a special tool to remove it. Basically, this tool is a 13/16in deep well socket with a slot cut into its side. Before installing the sensor, coat its threads with a special compound that contains glass beads. This compound prevents the sensor from seizing to the threads of the manifold, and is available from most auto parts stores.

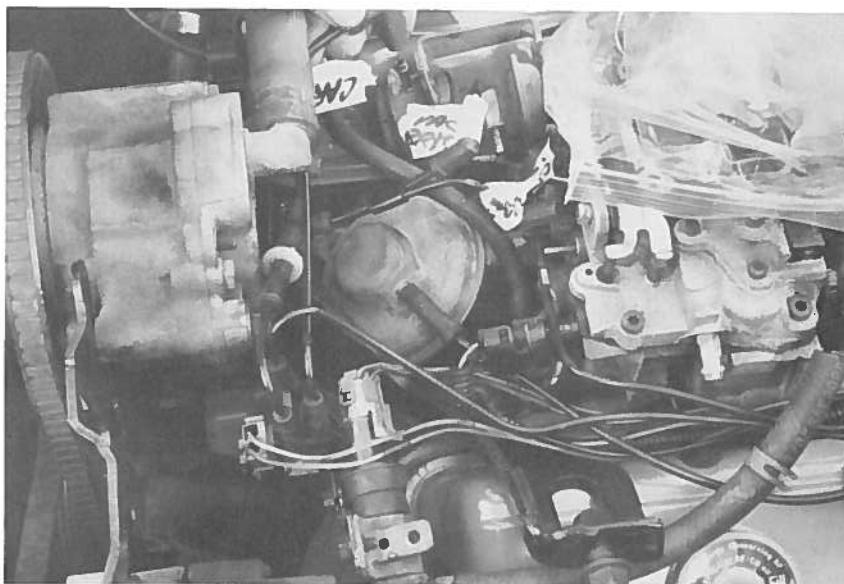
Vacuum Hoses

Vacuum hoses are the next items to connect. The vacuum hose that links the power brake booster to the inlet manifold is probably the most important. If this hose isn't connected to its port on the carburetor or throttle body, the engine will idle roughly—even more critical, you won't have any power assist to help you with your braking. This translates into much longer than normal stopping distances.

The purging of gasoline vapors in the vapor canister in many later-model cars and trucks is controlled by the on-board computer system. This is a simple system, consisting of tubing connecting the fuel tank to the engine intake system. Between this connection is the vapor canister with an electric solenoid. The solenoid opens and closes the vapor line leading to the engine intake system. When connecting this system, make sure that the vapor line is connected to the carburetor or inlet manifold and that the electrical connector is secured to the solenoid on the top of the vapor canister.

Upper Motor Mount

Begin installing the upper motor mount on front-wheel drive cars, by loosely attaching the motor mount bracket to the engine block. Then do the same for the bracket attached to the top of the radiator core support.



Note the number of vacuum hoses used in just this one area of the engine. If you can't find your notes on vacuum

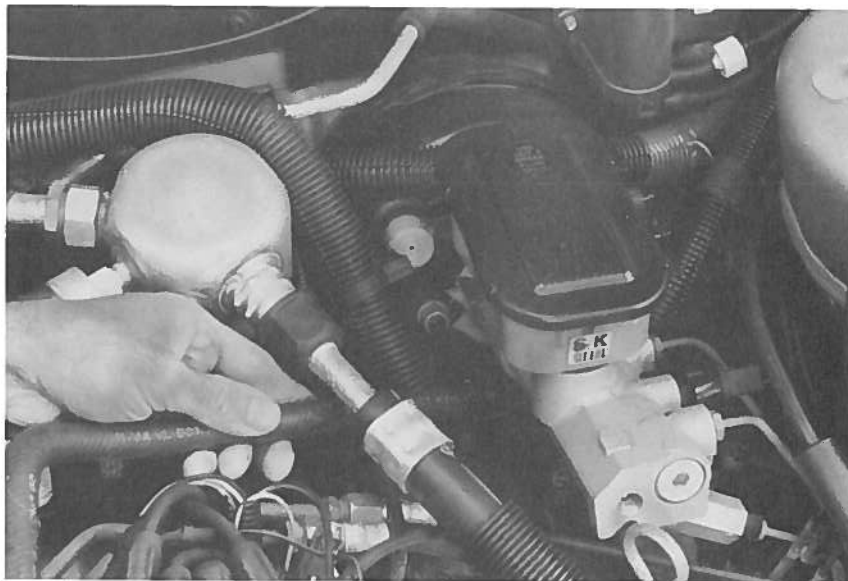
line routing, there is a decal in the engine compartment illustrating the routing.

Now take the front mount, which looks like a large dog bone, and align the hole from either end of it with the hole in the mounting bracket on the core support. With a washer under the head of one of the motor mount bolts, slide it through both the mount and bracket. Then slide another washer over the threaded end of the bolt and loosely install the nut. You

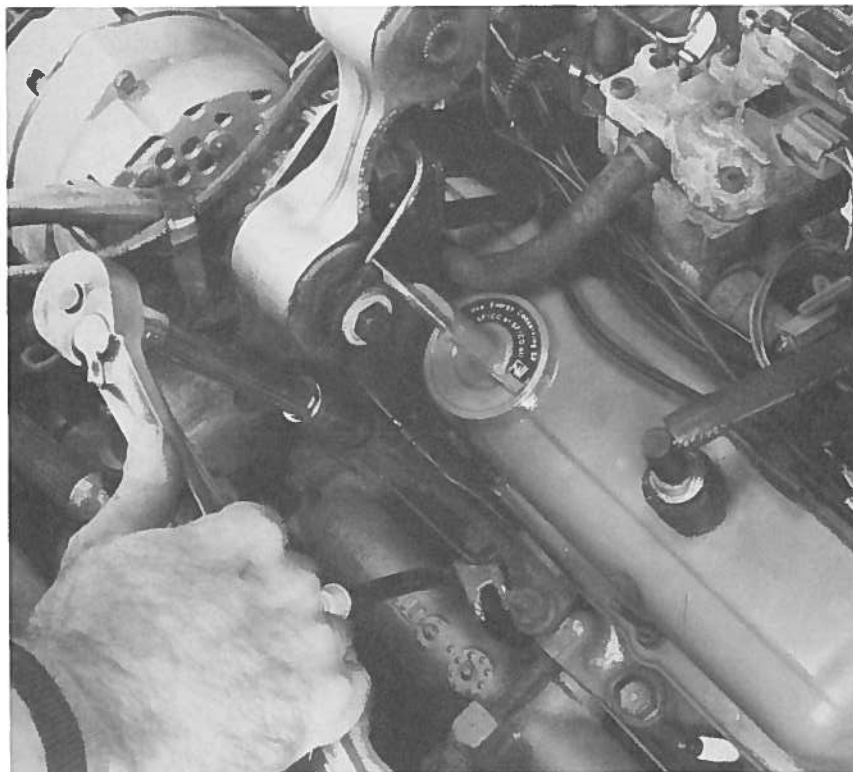
can attach the other end of the motor mount in the same manner, using this same procedure. However, you may need to push or pull the engine slightly to get the bolt through the mount.

Transmission Mount

If you had to loosen the transmission mount bolts to mate the engine

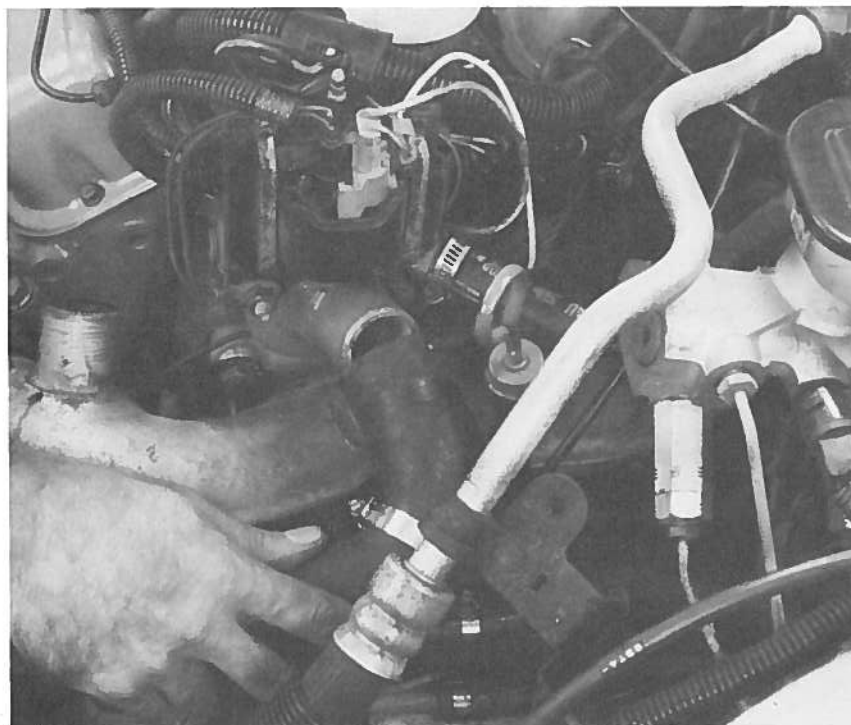


The rubber hose on the brake booster must be connected to the engine to maintain regular stopping distances.



Secure the top motor mount bracket to the studs at the exhaust ports on the front cylinder head. Don't forget to tuck

the forked mount for the dipstick under the left-most mounting nut.



Use new hose clamps to secure the radiator hoses, and don't forget about the heater hoses near the water pump.

with the transmission, tighten them at this time.

Radiator Hoses

Before installing the radiator hoses, lightly coat the inside of the hoses where they fit over the nipples on the engine or radiator with a waterproof grease. This makes it easier to remove the hoses the next time around.

Coolant

Fresh antifreeze mixed with water in the right ratio is critical to the operation and life of your engine. In addition to cooling your engine, this coolant solution has a higher boiling point than just plain water and helps guard against cooling system corrosion.

Begin filling the radiator with the coolant mixture after you're sure the radiator drain petcock is closed and the clamps on the heater core and radiator hoses are tight.

As you fill the radiator, the coolant will purge most of the air from the cooling system. This will cause the level of coolant in the radiator to drop immediately after the radiator is filled to the neck. This can happen repeatedly, so keep adding coolant to the radiator until it rises to the bottom of the neck and stays within line of it. This will ensure that there is enough coolant in the system to cool the engine.

After filling the radiator, check that the hose from the overflow reservoir is connected to the nipple on the side of the radiator neck. Then fill the overflow reservoir to the "Full Cold" mark.

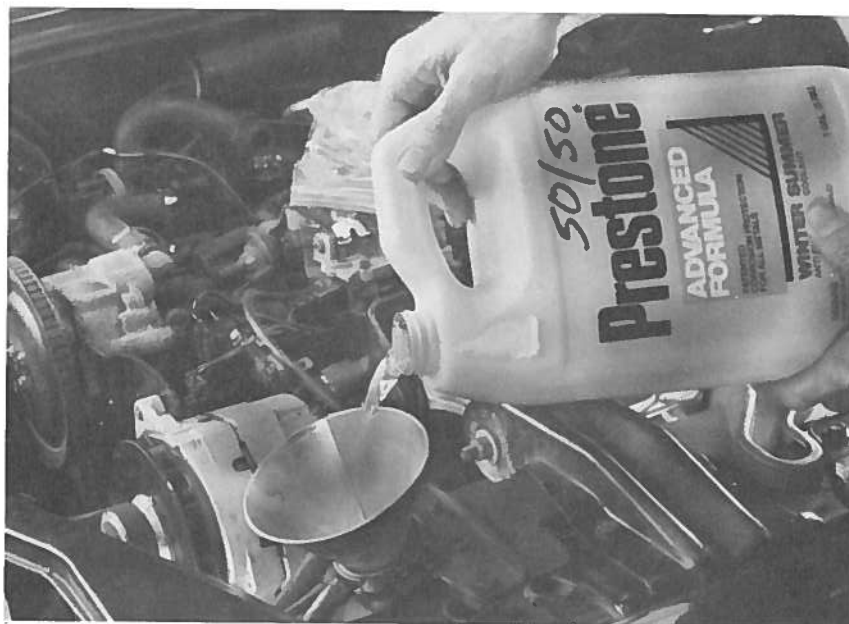
Throttle

The last item to check is the return action of the throttle. I knew a man who spent thousands of dollars building up his engine for some hot street action. It had a race cam, headers, and twin Holley four-barrel carbs. He was so anxious to start his "new" engine that he forgot to install the throttle return springs. As soon as he started it, the revs skyrocketed, and the rods blew through the side of the block, taking parts of the body sheet metal with them. Luckily, only his engine went to the graveyard!

To avoid an equally embarrassing and potentially deadly incident, make sure the throttle closes completely under the tension of the throttle return spring.

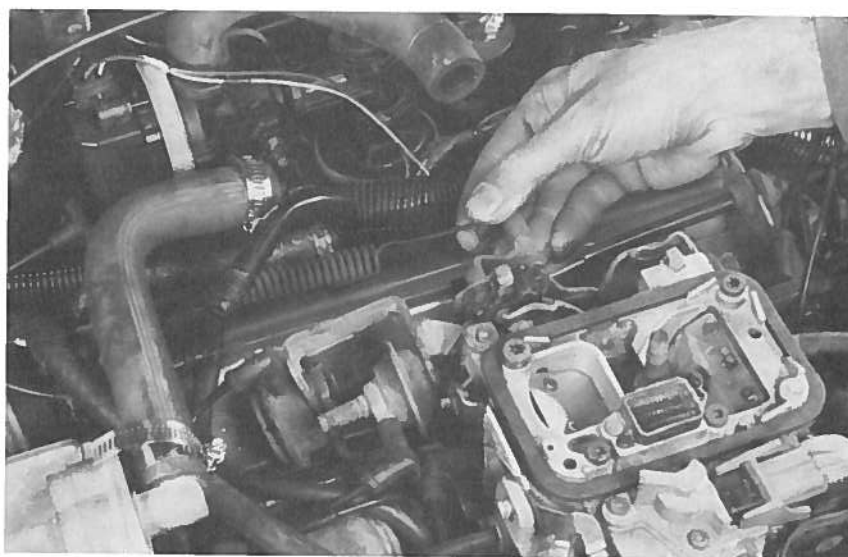
When you're confident that the wiring is correctly connected to the proper components, you can connect the negative battery terminal to the battery. As you're doing this, keep your eyes and ears open. If you see (or smell) any smoke or hear a sharp, cracking noise from the engine as you're connecting the terminal, immediately remove the terminal from the battery. Find out where the smoke or noise is coming from and correct it before trying to reconnect the battery.

With the battery connected, you should be ready to prepare for starting the engine.



Fill the radiator with a 50/50 mix of water and coolant. For greater protection, you can use up to 15% more coolant in

the mixture, but never use less than 50% coolant.



Before starting the engine, make sure that the throttle return spring is con-

nected and that the throttle closes fully. Don't start the engine until it does!

Break-In

8

Introduction

You've spent numerous hours painstakingly cleaning, assembling, and installing your engine. Your excitement begins to build and you can't wait to start it. This is definitely the time for the pay-off pitch, but don't rush now. If you do, you stand a good

chance of shortening your engine's life or worse. Instead, discipline yourself to work slowly and methodically. This will help prevent mistakes.

Before you start the engine, make sure all belts and hoses are securely connected. Check all the electrical connections to ensure they're

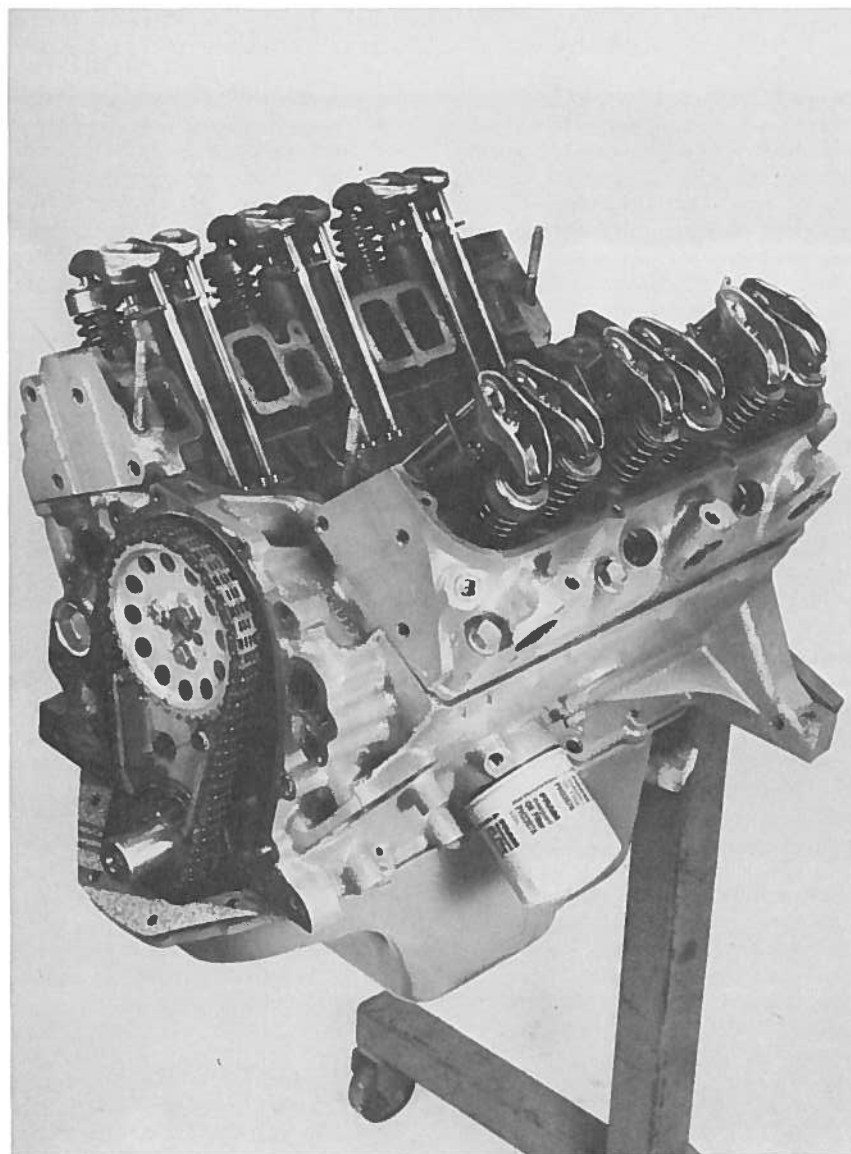
where they belong and aren't hanging where they can be caught by a spinning belt or be burned. Check the coolant and oil levels, and be sure there's enough fuel in the fuel tank to start the engine and run it for at least forty-five minutes. This is very important, because once you start the engine it needs to be run at 2000-4000rpm for thirty minutes to help break in the camshaft and lifters properly, preventing them from dying a quick, merciless death.

If you haven't already, prime the engine. For more information, refer to "Priming the Lubrication System" in Chapter 6. This prelubes the engine, preventing metal-to-metal contact and premature wear. Also, connect a mechanical oil pressure gauge so that you have an immediate and accurate idea of oil pressure. To install this gauge, remove the oil pressure switch on the side of the block and screw the gauge fitting into the hole. Route the gauge tubing away from anything sharp or hot, such as the exhaust system, and position the gauge so that it can easily be read. Oil pressure should rise to 55-70psi at 2000rpm if the outdoor temperature is around 70degF.

If oil pressure doesn't build, assume that the oil filter is plugged and replace it. Even if you've used a new oil filter it can still be plugged. Replace the filter and check for oil pressure once again while cranking the engine.

The last item to check is fuel flow. The cranking of the engine should have allowed the fuel pump to prime the fuel lines and carburetor. To check fuel flow, quickly open the throttle and watch for a stream of gas to flow into each carburetor venturi. On a carbureted engine, pour about half-an-ounce of gas down the carburetor just before starting the engine to prime it.

If the engine is equipped with any type of fuel injection system, all you need to do to prime the system is to turn the ignition key to the "RUN" position. You should hear the electric fuel pump in the tank run for a few



All the time and care you've expended during the assembly process can be for

naught if you don't break in the engine properly.